State of the Science

and

Practice:

Exercise and Nutrition

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Paper commissioned for an Invitational Conference on How Managed Care Can Help Older Persons Live Well with Chronic Conditions, Washington, D.C., Oct. 27-28, 1998. This conference was cosponsored by The National Institute on Aging.

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Background

There have probably been more treatment programs and research studies conducted on nutrition and weight loss interventions than any other health issue. The last decade has also seen an explosion of interest in and research on physical activity programs. This paper summarizes the results of research in these two areas, with particular emphasis on interventions in medical offices or other health care settings, and on programs for older adults and those with chronic illness.

Given the publication of recent authoritative summaries of the health and quality of life benefits of proper nutrition and regular exercise, it is no longer necessary to convince readers of the public health importance of these actions.[1,2] Rather, the questions we face today concern what programs are effective under what conditions, for what populations and how cost-effective are they? This paper summarizes answers to these questions, makes practical recommendations for, and identifies barriers to incorporating such interventions into managed care organizations. It begins, however, by considering the personal and social context surrounding lifestyle behaviors such as eating and activity patterns.

Conceptual Background Regarding Determinants of Health Behaviors

As discussed below and depicted in Figure 1, there are many factors which influence health promotion and disease prevention behavior and their outcomes.[3,4] The left side of the Figure 1 illustrates the multiple levels of factors that influence health behaviors. The center of the figure represents several different preventive health behaviors. These behaviors are listed

separately to illustrate that there is often only a modest relationship between the extent to which an individual engages in one lifestyle behavior and their level in other areas. Finally, the right-hand side of the figure depicts the consequences of health habits, including physiologic, quality of life, and health care utilization outcomes. It is important to stress that health behaviors and outcomes are not the same; physical activity and eating patterns are two of the multiple determinants of health outcomes (along with genetics, medication prescriptions, stress, comorbidities, disease severity, and other variables).[3,5,6] The point is that one cannot judge a patient's level of behavior from their lipids or other biologic outcomes. Poor metabolic results indicate that something is wrong, but they do not give specific information about what is wrong. A second important point is that good health outcomes and adjustment involve more than just low cholesterol and BMI levels: variables such as mental health status, and social, physical and role functioning (i.e., health-related quality of life) are equally or more important outcomes.[7-10] The following sections discuss how each of the health behavior determinants summarized on the left-hand side of Figure 1 can be utilized to improve dietary and physical activity behaviors.

Participant perspective. The most important factors in developing self-management goals are the participant's perspective on preventive behaviors and what changes she or he considers reasonable and realistic. Two important beliefs are that patients: 1) consider their personal risk to be serious, and 2) believe that what they do makes a difference.[11,12] Patients who don't hold these beliefs will likely not be motivated to engage in self-management behaviors. Such patients may need additional personalized feedback on their health risks[13] as well as education on the potential benefits of specific self-management behaviors. In particular, it is useful to assess how important and effective a person considers preventive lifestyle behaviors (e.g., diet and exercise) compared

to medical interventions (e.g., medication taking and surgery). If they do not view health behaviors as efficacious, they will be unlikely to follow-through with the challenges of lifestyle modification. Other important and related cognitive factors are a patient's readiness to adopt different self-management actions[14] and their self-efficacy or confidence that they can achieve specific goals.[15]

Health care team issues. As detailed elsewhere,[16,17] the physician office visit presents a ubiquitous opportunity to encourage and support health behavior change. Unfortunately, this opportunity is seldom utilized as well as it could be.[16,18,19] In the office setting, consistency and reinforcement of patient goals across different health care team members is critical. Rather than having the physician emphasize medication, the nurse stress symptom monitoring, and the nutritionist recommend major dietary changes, all team members need to reinforce a common self-management behavior for that visit. The patient needs to leave a given visit with a clear idea (and preferably, a written goal or contract sheet) of the key goal(s) for the next visit and an understanding of why the goal is important to them. When patients are given assignments, it is particularly important to review and comment on any records that the patient brings to the next visit or contact.

Insert Figure 1 here

The social environment. Self-management activities do not occur in a vacuum, but rather in a social context. If maintenance of self-management is to be expected, follow-up support must be arranged in the form of family and community social support, and follow-up contacts with

members of the health care team.[20] To produce lasting behavior change, comprehensive and coordinated efforts are necessary. These interventions will likely need to address each of the factors in the left-hand side of Figure 1, and to include links across the various determinants of self-management.

It is important to assess and incorporate both the patients' anticipated barriers to self-management and their available resources, at the level of 1) family and friends and 2) broader community influences including work and neighborhood factors.[3,21,22] This can be accomplished by asking what the patient thinks might interfere with the identified self-management goal(s). The clinician can then help the patient develop possible solutions, focusing on the use of available family, friend, and community resources. Most communities have available a series of free or low-cost support or reinforcement activities (e.g., voluntary health organization meetings; hospital, university, or HMO lectures or education programs; newsletters; YMCA, community center, or health club activities) that can help maintain the motivation patients receive during office visits. Anderson and Funnell[17] have provided a useful discussion and examples of community support options to reinforce physician messages about self-management.

Evaluation Framework

Before turning to the summary of the research, this section presents the framework that will be used to evaluate the extant literature. Termed the RE-AIM model, this framework focuses attention on important applicability issues and a real world, effectiveness perspective[23] compatible with the social and economic realities of implementing and maintaining behavior change programs at the end of the 20th century. There are five component dimensions to the RE-AIM model, which combine to determine the overall public health impact of an intervention: 1) Reach, or the percent

and representativeness of participants who are willing to take part in a given program; 2) Efficacy, or the impact of an intervention on important outcomes, including behavioral, biologic, quality of life, and economic outcomes. These issues operate at the individual level and have been discussed by others[24] as combining to determine overall impact (Reach x Efficacy = Impact). There are also three less often studied, but equally important outcomes, which concern impact at the level of the research setting (i.e., clinics, community centers, MCOs) in which a program is evaluated. These "AIM" dimensions are: 3) Adoption, or the percent and representativeness of settings that are willing to adopt or try an office innovation; 4) Implementation, or how consistently an intervention or procedure is delivered as intended; and 5) Maintenance, or the extent to which a program or policy becomes institutionalized or part of the routine practice of medical settings; at the individual level, maintenance refers to long-term behavior changes. These five factors interact to determine the overall "population-based" or public health impact of a program as illustrated in Table 1.

Insert Table 1 here

An example may help to illustrate how the RE-AIM evaluation framework can lead to surprising conclusions about the wisest use of scarce health care resources.[16] The basic assumption is that an intervention's impact is an interaction−represented as a multiplicative relationship in Table 1. Therefore, an intervention which is highly efficacious−say .7−(See Table 1)−(such as intensive, multisession, supervised group exercise or eating programs) but has very limited reach or appeal (.1) may prove to have little overall impact (.7 x .1 = .07) and less

population-wide benefit than a more modest intervention that has less efficacy (.3) but higher reach (.5) (.3 x .5 = .15).

This way of thinking about the population-based or public health impact of programs is new for many healthcare professionals. With the increasing emphasis on cost containment and accountability, evaluation criteria like these in the RE-AIM model become paramount. Most of our professional training has upheld the traditional double-blind randomized clinical trial as the "gold standard" method of evaluating interventions. While such trials have certainly advanced our knowledge, they often oversimplify clinical realities and emphasize internal validity (efficacy) at the expense of external validity. Much more research needs to be conducted on representative patient samples in representative clinical settings, conducted under "real-world" conditions to help in making important policy and resource allocation decisions.

This review will use the RE-AIM model to evaluate the extent of our knowledge about each of the 5 RE-AIM dimensions.

Overview of Studies

Table 2 summarizes the characteristics of the studies that have been conducted. The column headings list domains of the specific content (nutrition or physical activity), theory base, interventionist and modality, delivery setting, and sample studied. Listed in the columns, in order of how often they have been studied, are study characteristics. This section summarizes the types of research that have been conducted, and notes areas of recent attention, and those worthy of further investigation.

Although not as numerous as with younger age groups, there have been more studies on caloric restriction and weight loss than on other nutrition targets. More recent nutrition

investigations have focused on reducing dietary fat intake, especially saturated fats, and on "five a day" programs to increase fruit and vegetable consumption. In general, it appears that it may be somewhat easier to increase fruit and vegetable consumption than to produce meaningful decreases in dietary fat.

Similarly, different physical activity goals have been investigated. There has been a recent shift toward targeting 30 cumulative minutes of physical activity daily, following recent data and recommendations from the American College of Sports Medicine (1996)[25] and the U.S. Surgeon General's Report on Physical Activity (1996).[1] Their recommendations for more modest "lifestyle" activities that can more easily be incorporated into daily activities three times a week are much more feasible for the majority of older adults than were previous targets of vigorous aerobic-type activity for 20 minutes or longer, three times a week . There have been fewer studies, although some large-scale collaborative trials,[26] of interventions focused on exercises to increase flexibility or strength among seniors. Given the documented effectiveness of exercise in facilitating maintenance of weight loss[27-29] more studies are needed of combined risk factor interventions.

The second column of Table 2 shows that most studies have followed either a stage-of-change/transtheoretical model or a social-cognitive/self-efficacy conceptual framework. There have been far fewer studies based upon community-oriented, social-ecologic approaches to increasing physical activity.[21,22]

Insert Table 2 here

One of the advantages of using a RE-AIM approach to evaluate health promotion studies is that, as summarized in the last three columns of Table 2, it becomes strikingly apparent that the majority of studies have been conducted by research staff, in supervised facilities, with volunteer, highly motivated participants. This is especially true of nutrition studies; there have been somewhat more population-based and/or home-based interventions, [30,31] which reach a broader segment of the population, in the physical activity area. These "efficacy" studies[23] have been helpful in identifying basic mechanisms, but far more "effectiveness" research is needed on more representative populations, in more representative settings, conducted by regular staff.[32,33] The physical activity literature has more examples of such research and of low-intensity/lower cost intervention approaches[31] although there are some examples in the nutrition literature, especially employing computer-based interventions.[34-36]

A final issue stimulated by the information in Table 2 is the issue of population-based vs. high-risk patient intervention approaches. There have been strong arguments made on both sides of this issue[3,33] which often boil down to a preventive, public-health oriented approach vs. a more clinically-focused approach that targets "highest-cost service utilizers." As suggested elsewhere,[24,37] these approaches are not necessarily antithetical, although they have often been portrayed as such. They can be combined into a stepped-care approach in which brief, lower cost interventions are employed on a population-wide basis, and more intensive, costly interventions reserved for higher risk persons or those who do not succeed using the initial interventions.

General Conclusions on State of the Science

Great advances have been made over the past 20 years of research on the determinants and modification of eating and physical activity patterns. Table 3 lists general conclusions that are applicable to both dietary and physical activity interventions. Systematic reviews and meta-analyses have documented that well designed behavioral programs are effective in helping people, including older adults, change longstanding dietary and exercise patterns.[38-40] It also appears that individuals having chronic illness(es) are equally or more likely to be successful as those without diagnosed illness.[41-43] An interesting dilemma that has frustrated many health care professionals is the "Intervention Intensity/Reach Paradox," that the programs which appear most effective involve the most intensive treatment, including long term maintenance components.[28] The paradox is that such intensive programs are also precisely the interventions that attract the fewest participants.[44]

One way out of this dilemma may be to adopt a stepped care approach that begins by offering minimal and low intensity intervention programs (which are successful at producing moderate behavior change) to all members of a defined population (e.g., all HMO members) in places that they frequent for other reasons, such as medical offices and workplaces.[4,24] Persons who are at especially high risk and do not achieve satisfactory results from such low intensity interventions can then be helped and supported to try more intensive intervention options.[45,46]

Interventions that are most effective have generally adopted one or both of two theoretical approaches. The first is social cognitive theory,[15] which emphasizes the reciprocal interplay between personal factors, such as self-efficacy expectations and coping skills, and social factors such as prompts, incentives, and models of healthy or unhealthy behaviors. The other conceptual approach, which is reflective of changes in the healthcare environment to be more consumer-

based, is patient activation.[47-49] This approach conceptualizes and makes the patient the key decision maker, and personalizes intervention strategies based on patient preferences and readiness to change. Examples of this later approach are patient empowerment;[14,50] stage-of-change/transtheoretical model-based programs,[51] and motivational interviewing approaches.[52]

Insert Table 3 here

From the perspective of this reviewer, additional conceptual and empirical attention needs to be devoted to two related, additional areas: 1) Maintenance and factors determining long-term behavior change, and broader social environmental or contextual factors. Many interventions are successful in producing short-term change, but most are unsuccessful at producing lasting behavioral change.[28] Conceptual advances, especially relapse prevention theory[53] have identified determinants of relapse and improved our understanding of the relapse/maintenance process. Unfortunately, intervention based on this−or other−conceptual models have been less successful.[54]

Given that broader social context factors appear especially important in influencing long-term behavior change,[55,56] it may be that broader approaches, such as those represented by Stokols' social ecologic framework[21,57] or the "pyramid of psychosocial influences"[4,37] will be of value. These newer and more comprehensive theoretical frameworks help to rectify the exclusively intrapersonal focus of much previous work, but have yet to prove their value in designing effective interventions.

It is also increasingly clear that what is <u>not</u> effective in producing behavior change is traditional, didactic patient education programs that use classroom-based models of having

numerous medical professionals lecture to patients about the details of their disease and what they should do to control it. The following section identifies issues specific to nutrition and exercise, as well as an evaluation caveat; but, in general, the good news is that relatively brief and low-cost behavioral interventions have been documented to be effective in well-controlled, randomized trials. The bad news is that these interventions are seldom incorporated into managed care or other health care settings.

Area-specific issues: nutrition. It appears possible to change some patterns such as eating more fruits and vegetables, more easily than others such as increasing grain and legume consumption. A number of interventions have successfully reduced dietary fat intake. These interventions do not always translate directly into weight loss or other biologic outcomes such as reduced blood pressure or serum cholesterol levels, outcomes that are often influenced by multiple factors, including medications in chronic illness populations.[3,5,6] Recent computer based applications have proven successful and have several potential advantages such as reduced staff time, increased consistency of implementation, and personalization of intervention.[34-36,58] Recent studies have documented the cost effectiveness of medical nutrition therapy for chronically ill patients.[59]

Exercise. Many different interventions, including home based programs,[31] and those initiated in the hospital or medical setting, and continued at home have proven effective. The recent research on and modified recommendations regarding the benefits of daily, moderate physical activity (as contrasted with aerobic level exercise) makes it more feasible for the general population, and especially older persons and those with chronic illnesses, to participate in and benefit from exercise programs.[60] More research is needed on the cost-effectiveness and long-

term effects of different physical activity programs, and on programs that combine endurance, strength, and flexibility components.

An evaluation caveat. One caveat is that to date, most nutrition and exercise studies have studied highly motivated and self-selected participants (as have almost all other clinical trials). From the RE-Aim evaluation perspective, much more research is needed on the reach, effectiveness, implementation, and maintenance of interventions with more representative and defined populations (such as members of a managed care organization).[32] In addition, since one of the most promising locations in which to implement nutrition and exercise programs is health care settings, more research needs to be conducted on factors related to the adoption and institutionalization of such practices, and priority given to effectiveness and dissemination research in settings with limited resources and expertise.[32]

Practical Implications

Recent research syntheses of the evidence on health behavior change, including patients with chronic illness and the elderly, has concluded that successful intervention and practice innovations have four common characteristics.[61,62] These characteristics, which should be considered as an ongoing and self-correcting cycle of activities conducted over time, consist of: 1) collaboratively setting goals with informed and activated patients; 2) identifying barriers and support resources for achieving these goals; 3) personalized training in problem solving strategies, and finally; 4) follow-up support. It is also significant that these four steps are very parallel to the "PDSA" cycle (Plan-Do-Study-Act) of successful organizational changes recommended by consultants to health care organizations interested in adopting practice innovations.[63] The literature contains numerous illustrations of different ways to implement these strategies. It is

important to emphasize that there does NOT appear to be any single magic treatment strategy or profession that is most successful with nutrition or physical activity interventions, but rather the set of practices summarized above, conducted over time and when possible, by multiple sources, that produces the best outcomes.

The "cycle of care" activities above (goal setting, identifying barriers, problem-solving training, follow-up support) appear to achieve their results through several mechanisms, which are important to understand and which themselves have health care implications. These mechanisms, or intermediate outcomes, include increased patient satisfaction, improved self-efficacy for accomplishing behavior change,[15] learning of practical problem-solving skills (as contrasted with academic knowledge of organ systems taught in traditional patient education courses), and possibly most important, inclusion of social environmental support.[4] Patients do not live in a vacuum, but rather a complex social milieu, elements of which support or interfere with nutrition and physical activity goals. Successful interventions do not so much change the patient, as help the participant rearrange her or his social environment--including medical office practices and the patient-health care setting relationship--so that they more consistently support behavior change.[4,57,64]

Barriers to Adoption of Best Counseling Practices

Most health care personnel, from physicians on down, would like to "do the right thing" and believe, at least on an abstract level, in prevention activities. However, they have a number of barriers (real and perceived) to adopting the practices outlined above.[65,66] These barriers and potential solutions are outlined in Table 4. The extent to which a health care organization is successful in addressing these and other idiosyncratic barriers will determine the extent to which it

is successful at achieving population-based changes in nutrition and physical activity among its members.

There are three general types of barriers, and related solutions, listed in Table 4: resource, information, and logistical. Resource barriers (Items 1-3) include the time and skills to conduct behavior change counseling. These concerns can be addressed by institutional office practices that redesign patient visits to better deal with prevention and patient-focused issues, by efficient computer-based and other automated assessment and intervention methods, and by training health care team members in brief intervention techniques. Information and logistical barriers (Items 4-7) include the lack of relevant information when it is needed, as well as the lack of feedback on patient status and office practices. These barriers can be addressed by clinical information systems that provide user-friendly summaries and prompts based on evidence-based guidelines.[66]

Insert Table 4 here

Summary and Recommendations

The potential for application of theory and evidence-based behavioral interventions to facilitate nutrition, physical activity and other lifestyle changes in managed care settings is great. Contrary to stereotypes, older persons with chronic illnesses can make important improvements in longstanding health habits.[67] Approaches that seem particularly ready for testing and application in managed care settings include computer-based, personalized interventions;[53] patient-centered motivational interviewing practices;[52] and follow-up telephone counseling.[20] This potential will

only become realized, however, if and when organizational and systems changes[63] are instituted that address the barriers in Table 4. To accomplish this, it is necessary to alter the way chronic illnesses are treated in our country,[37,68] and to integrate these behavioral interventions with the rest of the patient's care in a proactive, patient-centered manner.[4,69]

Promising approaches and emerging issues that merit additional testing, but are not yet ready for widespread application in managed care settings include: 1) intervention approaches that include psychosocial and emotional coping strategies (Spiegal–this volume), especially those targeting depression;[70] 2) programs that address multiple risk factors, such as nutrition, physical activity, and smoking cessation in an integrated fashion; as well as "disease management" interventions that address those factors in a consistent way instead of disease by disease;[61,62] and 3) different theoretical approaches for matching interventions to patients and for tailoring behavior change communications and 4) programs that address broader social-ecological factors, are conducted in community settings by lay educators, and help participants redesign their social environment.

Much has been learned and significant advances made since over 15 years ago, Stunkard and Stellar (1984)[71] characterized nutrition and weight loss interventions by a statement to the effect that of those who were overweight, the majority would not come for treatment, of these who came, the majority would drop out, of those who remained the majority could not lose significant amounts of weight, and of those who did lose weight, the majority would regain it. We still have far to go, however, to understand specifically what types of interventions are most effective for what types of patients when delivered in which types of settings. It is hoped that attention to issues raised in this paper will help us to "RE-AIM" our conceptual, intervention, and

evaluation approaches to produce even more effective and practical physical activity and nutrition interventions, capable of producing population-based outcomes and improving the quality of life of older citizens.

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Table 1

Component Dimensions of the RE-AIM Evaluation Framework

	% REACH (what proportion of the panel of patients in each setting will receive or be willing and able to participate in this intervention?)
X	% EFFICACY (success rates if implemented as in guidelines: Defined as positive outcomes minus negative outcomes)
X	% ADOPTION (how many settings, practices and plans will adopt this intervention?)
X	% IMPLEMENTATION (how often is the intervention implemented as intended in the real world?)
X	% MAINTENANCE (extent to which program is sustained over time)
=	PUBLIC HEALTH IMPACT (population-based effects) of an Intervention.

Table 2
Characteristics of Nutrition and Physical Activity
Interventions for the Elderly

Content	Theory	Intervention Delivery	Intervention Setting	Sample Studied
Nutrition Caloric Reduction Fat Reduction Fruits & Vegetables Fiber Physical Activity Lifestyle - walking Aerobics Flexibility Strength Combined Risk Factor Program	Stage-based Readiness to change Social cognitive Social/Environmental/ Ecologic Social Marketing Mixture Other None	Professional Research Staff Regular Health Staff Telephone Counseling Computer Generated Peer Educator	Medical Setting Supervised Facility Group Meeting Home Based Mixture	Unspecified Volunteers High risk or diagnosed illness Low risk or healthy Entire population or representative

Listings arranged in order of frequency of study, with most studied approaches being listed at top

Table 3: General Conclusions--State of the Science

1. Appropriately designed, minimal to moderate intensity programs are moderately successful in producing behavior change

2. To produce substantial behavior change, more intensive interventions are necessary

3. To produce long lasting behavior change, some form of environmental change or periodic, ongoing support and contact is necessary

4. Health care settings provide important, generally underutilized opportunities (teachable moments) to initiate, coordinate, and conduct lifestyle change interventions

Table 4: Barriers to Health Care Professionals Conducting Lifestyle Counseling, and Possible Solutions

Barrier (Perceived or Real)	Possible Solutions
1. "Not enough time" (competing priorities) 2. Cost 3. Lack of skill, training, and confidence in behavior change skills 4. Low outcome expectations 5. Lack of information on patient status, risks, preferences and barriers 6. No incentives (or disincentives) 7. No feedback or CQI information or support	1. Automate, make priority, redesign practice procedures & roles 2. Initial vs. ongoing investment 3. Training in brief interventions, systems change 4. Adjust expectations; pilot demonstrations 5. Prompts and summaries for patients and providers 6. Provide incentives for following best practices 7. Clear, timely feedback on use of best practices

Figure 1. Diagram of Influences on and Consequences of Lifestyle Behaviors